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AMP UP THE WRAPPERS: MULTIPLE METACOGNITIVE WRAPPERS DO NOT IMPROVE STUDENT ACADEMIC PERFORMANCE NOR METACOGNITION IN A SINGLE-COURSE INTERVENTION

A Thesis
By
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Abstract

AMP UP THE WRAPPERS: MULTIPLE METACOGNITIVE WRAPPERS DO NOT IMPROVE STUDENT ACADEMIC PERFORMANCE NOR METACOGNITION IN A SINGLE-COURSE INTERVENTION

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Cognitive development, namely metacognition, is essential to student success in higher education. However, many students often struggle to meet the rigorous cognitive demands of colleges and universities, and they lack the metacognitive skills that would support their academic success. One potential way instructors can foster students' development of metacognition and increase academic performance is through student reflection on instructor feedback via post-activity and post-exam reflection exercises (i.e., metacognitive wrappers). However, past research shows mixed results on whether engaging in metacognitive wrappers can improve academic performance and metacognitive skills. The present study aims to investigate whether increasing the number of and varying the type of metacognitive wrappers can augment academic performance and metacognitive awareness. Undergraduate students enrolled in two sections of an educational psychology course (N = 99) were randomly assigned to one of two conditions (metacognitive reflection or control reflection). Over the semester, students completed a pre- and post-Metacognitive Awareness Inventory questionnaire and four exam and activity reflections. To test the main hypotheses, I

used ANOVAs to analyze students' scores on each of the two mandatory exams and their final grades in the course across two conditions to determine whether there was an effect of metacognitive wrappers on academic performance. To determine the change in metacognitive skills over the semester by reflection type, I conducted a repeated measures ANOVA. Results showed no improvement in academic performance nor metacognitive skills due to exam wrappers. Though the results of this study showed that an increased number of and variety of wrappers had no improvement of academic performance nor metacognitive awareness due to exam wrappers, it does provide researchers a robust experimental framework to model in future studies.

Keywords: student academic performance, metacognition, metacognitive wrappers

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Lastly, and most importantly, a huge thank you to my partner, Drake Parsons, for proofreading all of my drafts, painfully listening to almost every practice presentation, and maintaining my sanity during these years. I could not have done it without you.

Dedication

I dedicate my thesis to everyone who has motivated and inspired me to get to this point – Dr. Chris Baker for chatting with me about the importance of graduate school before I even understood what graduate school was; Dr. Diana Morelen for guiding me when I was interested in clinical psychology while maintaining her warm and supporting composure as a mentor, even today; and especially to my advisor, Dr. Lindsay Masland for shining light on how remarkable the Scholarship of Teaching and Learning research truly is.

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Introduction

Research suggests that metacognitive skills are essential for higher learning (Everson & Tobias, 1998). Defined as awareness of and knowledge about one's own cognitive processes (Flavell, 1979), metacognition has been shown to strongly and positively correlate with academic performance (e.g., Coutinho, 2008; Osman & Hannafin, 1992; Rahmat & Chanuna, 2018). However, few college instructors use explicit methods to promote metacognitive skills (Ellis et al., 2014). Perhaps one way instructors in higher education can prepare students to succeed is through *scaffolding* metacognitive skills. Scaffolding, much like the temporary structure on the outside of a building to aid in construction, is a supportive teaching technique in which assistance is modified based on the learner's progress. A particular type of scaffolding, instructor feedback, has one of the largest effect sizes in terms of instructor effects on student learning (Hattie, 2015). However, only a little over half of students (57.1%) actually look at and respond to the feedback provided to them on an exam at least once during the course of a semester (Sato et al., 2018). A potential way to encourage students to view instructor feedback is via post-exam and post-activity reflection (i.e., metacognitive wrappers), which could serve as a metacognitive scaffolding mechanism.

Metacognitive wrappers show promise for developing metacognitive skills (e.g., Lovett, 2013) as well as improving academic performance (e.g., Achacoso, 2005; Edlund, 2020). Specifically, a metacognitive wrapper is a short task that provides a scaffolding structure in which students reflect on exam or activity performance once the instructor has provided feedback. In theory, this allows students the opportunity to reflect on past performance so that they can improve performance on a future exam or activity. In terms of academic performance, a recent study found an increase in exam scores for those who

completed metacognitive wrappers compared to those in a control condition (Edlund, 2020). There is also some research to support the notion that metacognitive wrappers have enhanced metacognitive skills across the semester (Craig, Horton, Zingaro, & Heap, 2016; Lovett, 2013). However, not all research has demonstrated significant effects for metacognitive wrappers on academic performance and metacognitive skills (e.g., Soicher & Gurung, 2017; Thompson, 2012). In some studies, metacognitive skills improved across the semester regardless of whether students engaged in metacognitive wrappers. In other words, these studies suggest that the effect is not a result of students engaging in post-exam and post-activity wrappers. Instead, students appear to develop metacognitive skills across the semester naturally, regardless of intervention. In addition to these conflicting findings, there has been a paucity of research demonstrating effects of metacognitive wrappers on student academic achievement. Thus, additional research is needed to understand the conditions under which metacognitive wrappers improve academic performance and whether metacognitive wrappers have a significant positive impact on metacognitive skills.

The current study investigates student academic performance in an educational psychology course at a masters' comprehensive institution in the southeast. This study used an experimental design across two course sections of an educational psychology class to replicate and extend the existing research on post-exam and post-activity wrappers by increasing the number of wrappers students complete across the semester. I examined whether in-class activities that involve student interaction with instructor feedback lead to improved scores on exams and on the overall grade for the course. I also investigated changes in metacognitive awareness from the beginning to the end of the semester. Using a pre- and a post-measure of metacognitive skills, I sought to determine (1) whether

metacognitive skills increase from the beginning to the end of the semester, and (2) whether metacognitive skills improve as a function of engaging in post-exam and post-activity metacognitive wrappers.

Metacognition and Learning

In terms of learning, metacognition involves students thinking about how they studied for a test, using strategies to monitor and check their comprehension while reading course materials and class notes, reflecting on their own strengths and weaknesses, being aware of study strategies that work for them, and considering how to adjust learning strategies to improve performance on subsequent course work (Pintrich, 2002). Moreover, metacognitive skills help students plan, monitor, and regulate their learning and thinking, which are essential for becoming a self-regulated learner (Zimmerman, 2002). In recent years, psychologists have investigated the relationship between metacognitive abilities and academic performance. As previously stated, research shows that students with more metacognitive skills tend to have better academic performance outcomes (Coutinho, 2008; Osman & Hannafin, 1992; Rahmat & Chanuna, 2018). More specifically, Rahmat and Chanuna (2018) found students who engaged in assessments that required a higher-level thinking (i.e., metacognitive thinking) performed better than the control condition regardless of the students' level of cognitive ability (i.e., high and low cognitive ability). Considering these promising findings, instructors should consider their role in advancing students' metacognitive abilities in order to improve academically.

Self-regulation learning theory is one widely accepted framework regarding metacognitive processes (Zimmerman, 1986). According to the self-regulation framework, the responsibility of learning shifts from the instructor to the students. Students are thus

required to effectively "plan, organize, self-instruct, self-monitor, and self-evaluate [learning]… during the learning process" (Zimmerman, 1986, p. 308). As such, students who develop strong metacognitive skills should perform better in courses because they are better able to regulate the behaviors that lead to achievement. Additionally, Zimmerman (2002) claimed that self-regulated learners are proactive in their learning, meaning they initiate and facilitate their own learning since they are aware of their own strengths and weaknesses, as well as their ability to monitor and control their learning strategies. Furthermore, Zimmerman states that the self-reflective phase is an essential part of self-evaluation that allows students to set and achieve goals. Thus, instructors should allow students time to reflect on past work in order to grow as learners.

Moreover, metacognitive knowledge and self-regulation are key to acquiring new knowledge, especially at the college level (Ambrose et al., 2010). Everson and Tobias (1998) stated that it is necessary for students to develop metacognitive skills in order to assimilate large quantities of new and changing knowledge across several courses and curricula. However, many college students lack the development of such skills and often struggle to meet the demands of higher learning (Arum & Roksa, 2011). Thus, students need to be taught the skills necessary to self-assess, reflect, and regulate their own knowledge so that they can develop metacognitive skills that might enhance their learning.

Given that metacognition correlates with and can improve academic performance, it is important for instructors in higher education to establish and strengthen metacognitive skills throughout the semester so that students can improve performance. Metacognitive interventions, for instance, allow students to "focus on ... self-management for learning … [such as] planning, implementing, and monitoring one's learning efforts, and on the

conditional knowledge of when, where, why, and how to use particular tactics and strategies in their appropriate contexts" (Hattie et al., 1996, p. 100). One such metacognitive intervention that seems to improve student learning is for instructors to scaffold student learning through instructor feedback (Hattie, 2015), which might also help students develop metacognitive awareness. Scaffolding students involves supporting learning by systematically building on the new knowledge and skills students are acquiring in the classroom. According to Vygotsky (1978), students have a zone of proximal development in which they have a set of skills or knowledge that are just out of reach of their understanding but can be achieved with the guidance of someone else. In this theory, instructors can facilitate learning by building new information on what is already known using scaffolding techniques. As students' abilities develop, scaffolding can be reduced or eliminated. A good way to provide a scaffolding structure is through instructor feedback, and research indicates that metacognitive processes are sensitive to such feedback (Rhodes & Tauber, 2011).

Currently, there are many ways instructors attempt to promote metacognition to improve learning. Almost all such metacognitive interventions require students to reflect on their own learning so that they become more self-directed, autonomous learners (Redish & Hammer, 2009). Some instructors have students reflect on and gauge their progress in the course (Chasteen, 2017). Others have effectively supported metacognition in the classroom through reflective journal writing (Kurt & Kurt, 2017). Though these metacognitive interventions seem promising, a majority of students still are unaware of their own metacognitive strategies that could aid in their learning (McCabe, 2011), so additional research is needed to understand which types of metacognitive interventions work best for students.

Metacognitive Wrappers

Metacognitive wrappers are a type of reflection activity in which students consider instructor feedback, their own strengths and weaknesses in an activity (e.g., exam, quiz, assignment), the effort they put into completing the activity, and their goals to improve performance on future activities. Metacognitive wrappers, often referred to as exam wrappers, were introduced by Lovett (2013), and they provide students with a scaffolding structure to reflect on exam performance in a way that leads them to take responsibility and ownership for their learning. Particularly, exam wrappers can ask students how they prepared for an exam, what kinds of errors they made, and how they should study for the next exam. In their original formulation, Lovett also stated that instructors should create multiple opportunities for students to practice metacognitive skills in a diverse range of situations and assessments (e.g., quizzes, assignments, projects, lectures). Metacognitive wrappers are thought to be a useful class activity as they exercise skills instructors want their students to learn, impinge minimally on class time, are easily completed by students, are easily adaptable across many types of assessments, and are repeatable and flexible. Logically, as the name and purpose of wrappers imply, metacognitive wrappers should scaffold metacognitive skills and increase academic performance. In essence, metacognitive wrappers have strong face validity; however, few studies have actually investigated the effects of metacognitive wrappers on metacognitive skills and academic performance. Of the studies that do exist, there are mixed findings.

Beneficial Effects of Metacognitive Wrappers

A notable amount of research has focused on students' attitudes toward metacognitive reflections. Generally, students are satisfied with and have positive attitudes toward

completing these wrappers. For example, one study demonstrated that students believed wrappers were helpful in improving study habits and exam scores (Gezer-Templeton et al., 2017). In another study, students reported an increase in motivation for the next exam after completing an exam wrapper (Achacoso, 2005). Chew et al. (2016) extended the typical wrapper intervention protocol by adding two homework wrappers, in addition to the more typical exam wrappers. In this study, findings revealed that students felt more confident about their performance on exams after engaging in wrappers and felt "moderately satisfied" with the metacognitive wrapper process. Though these findings are promising, it is important to examine whether metacognitive wrappers are actually improving academic performance and metacognition, which are arguably more important outcome variables than student satisfaction.

In some cases, metacognitive wrappers appear to be effective at increasing academic performance. Specifically, an improved grade on the exam following the completion of a metacognitive wrapper is a common finding (e.g., Achacoso, 2005; Pate et al.2019; Smith et al. 2019; Thompson, 2012). However, most of the studies that report positive academic effects have significant methodological confounds or problematic reporting conventions, such as self-selection into control/wrapper condition (e.g., Pate et al., 2019), lack of a control condition (e.g., Smith et al., 2019), or failure to report quantitative results (Achacoso, 2005). A more recent and rigorous study which investigated metacognitive wrappers in a psychology course found that exam scores for students in the exam wrapper condition did significantly improve compared to the control condition, thus, leading the author to conclude that exam wrappers are effective and easy to use (Edlund, 2020).

Also of note, exam wrappers have been shown to significantly improve cognitive skills. In one study, critical thinking skills increased from an average of 75% to 86% (Lemons et al., 2013), indicating that even one wrapper is helpful in promoting higher levels of cognition. Another study found that students in the exam wrapper condition who completed two metacognitive wrappers were better able to predict their own exam scores and had enhanced metacognition compared to those in the control condition (Thompson, 2012). In a more recent study, following wrappers, students were better able to identify their mistakes in homework assignments and exams, which indicate that self-monitoring metacognitive skills improved (Chew et al., 2016). Results from another study indicate students enrolled in three courses, all of which used exam wrappers, showed an increase in metacognitive skills (Lovett, 2013). These findings, combined with the findings regarding academic performance, show promise for the use of metacognitive wrappers.

Null Effects of Metacognitive Wrappers

Although there is evidence to suggest metacognitive wrappers are effective, some studies suggest otherwise. Recent research shows null effects for metacognitive wrappers on academic performance (e.g., Ambrose et al., 2010; Chew et al., 2016; Lovett, 2013; Pate et al., 2019; Smith et al., 2019; Thompson, 2012), and methodological shortcomings could have contributed to these null results. For instance, in one study, the type of exam was not consistent across the semester (Chew et al., 2016); the first exam was completed in class, while the second exam was take-home, which may have had an unintended impact on academic performance. Another issue with research regarding metacognitive wrappers is that some studies have drawn conclusions after using only one wrapper after a midterm exam (e.g., Lemons et al., 2013; Stephenson et al., 2017). For instance, some researchers have

found no effect for a single exam wrapper on academic performance in terms of increased grades (Lemons et al., 2013) or on final exam performance (Stephenson et al., 2017), suggesting that there are sometimes no performance benefits of exam wrappers.

In an attempt to increase the strength of a wrapper intervention, Soicher and Gurung (2017) maximized the number of exam wrappers for a single course with a total of three exam wrappers for all three tests for an introductory psychology course. However, results indicated that final grades, exam grades, and metacognitive skills for students in the exam wrapper condition did not significantly differ from the control condition. Similarly, Butzler (2016) utilized exam wrappers after every exam and found no significant effects on academic performance, although the actual number of exams given was not reported. Additionally, in a study where students engaged in three exam wrappers across the semester, average exam scores remained consistent for all exams across the semester, indicating that exam wrappers did not increase performance (Smith et al., 2019). Even in a study with a control condition for comparison and an increase from one to two exam wrappers, academic performance was not improved through exam wrappers (Thompson, 2012). Furthermore, it should be noted that some of the articles purporting positive effects on academic performance do not report actual data when drawing conclusions regarding the effects of metacognitive wrappers (e.g., Achacoso, 2005; Gezer-Templeton et al., 2017), so it is impossible for others to evaluate the validity of their claims.

Regarding metacognition, some past research shows that students' metacognitive skills improve over a semester regardless of scaffolding techniques or metacognitive interventions. For example, in one study, students demonstrated a 4-5% increase in self-monitoring practices over the semester (Thompson, 2012). However, this increase was shown

for all students, regardless of condition, indicating that students in the exam wrapper condition did not have significantly more gains in metacognitive skills than the control condition. Similarly, Soicher and Gurung (2017) demonstrated condition-independent improvements in metacognitive skills across all students in a course, further calling into question the effects of metacognitive wrappers.

Given that past research regarding the effects of metacognitive wrappers on academic performance and metacognitive skills is inconsistent, additional investigation is needed to understand such effects (or lack thereof). A possible hypothesis for the inconsistent findings pertains to the *dose* of this metacognitive intervention. In many studies, students were not given the opportunity to engage in multiple wrappers throughout the semester, which contrasts with Lovett's original conceptualization of the intervention. As a reminder, Lovett (2013) states instructors should consider creating multiple opportunities for students to practice metacognitive skills in a diverse range of situations and assessments such as homework assignments, in-class assignments, and after class lectures. Although Lovett notes that repeating exam wrappers for subsequent exams is optional (but desirable), she explains that repeated practice may be key to improving metacognition and academic performance. However, few studies have used a large number of metacognitive wrappers in class. Furthermore, of these studies, only one (Chew et al., 2016) used wrappers to scaffold learning for activities other than exams, and these authors concluded that future research should increase the number and type of wrappers provided in a course. To overcome the limitations of previous work and to extend our understanding of the conditions which lead to improved performance and metacognition, more research is needed.

The Present Study

The current study investigated whether an increased number and variety of metacognitive wrappers would promote metacognition and academic performance in a single-course intervention. Similar to Chew et al. (2016), this study utilized both exam wrappers and activity wrappers four times throughout the semester. In this experimental design, students enrolled in two sections of an educational psychology course were randomly assigned to one of two conditions: career reflection or metacognitive wrapper. In the career reflection condition (i.e., active control), students completed sham wrappers that required non-metacognitive reflection related to an assessment or activity. Students in the metacognitive wrapper condition (i.e., intervention) completed metacognitive reflections related to instructor feedback regarding student performance following the first two exams in the course and two in-class activities.

In light of past research and self-regulation learning theory, I hypothesized that students who engaged in metacognitive wrappers would have better performance outcomes (i.e., final grade) than those who did not engage in metacognitive wrappers. Additionally, I expected students in the metacognitive wrapper condition to improve more on subsequent exams compared to the control condition. In line with the theory of scaffolding (i.e., that students are supported through reflecting on instructor feedback), those who reflect on their progress via exam wrappers should perform better on subsequent tasks. In other words, I expected students in the metacognitive wrapper condition to perform better in the course than students in the career reflection condition.

In addition to examining academic performance, I explored the relationship between wrappers and metacognitive skills. I investigated (1) whether metacognitive skills increase

from the beginning of the course to the end of the course, and (2) whether students in the metacognitive wrapper condition display a greater increase in metacognitive skills than those in the control condition. Consistent with self-regulation learning theory, I hypothesized that metacognitive skills would improve across the semester. Specifically, I expected metacognitive skills to increase more for students in the metacognitive wrapper condition compared to the control condition. Research has found that metacognitive skills generally increased from the beginning of the semester to the end of the semester (Soicher & Gurung, 2017; Thompson, 2012), but has yet to find a link between wrappers and metacognitive skills for this quantity of wrappers. As such, the current study explored the relationship of metacognitive wrappers on performance and metacognition when completing four wrappers of two different types across the semester.

Method

Participants

Students ($N = 99$) enrolled in one of two sections of an undergraduate educational psychology course taught by a single instructor at a master's comprehensive state university in the southeastern United States (approximately 19,000 students enrolled annually) were recruited as participants. Of the 99 students enrolled in the course, a majority ($n = 86$) consented to participate in the study. Further, this course consisted of mostly junior and senior undergraduate students and was one of three required foundational courses for obtaining a degree in education. Student grades did not depend on participation in the study, and students who chose not to participate in the study were not penalized.

Materials

Metacognitive Awareness Inventory (MAI)

Students' self-regulated practices and knowledge of cognition for learning in this class were assessed with the Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994). The MAI (Appendix A) is a multidimensional scale that measures metacognitive skills related to Knowledge About Cognition and Regulation of Cognition through 52 dichotomous items where each item was awarded 1 pointed for "true" responses and zero points for "false" responses. Using Cronbach's (1951) alpha, I found the MAI had good reliability overall for Time 1 (α = .84) and excellent reliability for Time 2 (α = .91).

Within the Knowledge About Cognition dimension, there are three subscales. The first subscale, Procedural Knowledge, measured knowledge about how to implement learning procedures or strategies (e.g. "I have a specific purpose for each strategy I use"). The second subscale, Declarative Knowledge, measured factual knowledge needed for critical thinking as well as knowledge of one's skills, intellectual resources, and abilities (e.g., "I understand my intellectual strengths and weaknesses"). The last measured Conditional Knowledge, or the knowledge to determine under what conditions specific processes or skills should transfer to a situation (e.g., "I know when each strategy I use will be most effective"). The Knowledge about Cognition Dimension of the MAI had poor internal reliability for Time 1 (α = .59) and questionable reliability for Time 2 (α = .61).

The second dimension, Regulation of Cognition, consisted of five subscales. The Planning subscale measured allocation of resources prior to learning and goal setting (e.g., "I set specific goals before I begin a task"). Information Management Strategies refer to how students processed information efficiently, such as organization, elaboration, and

summarizing (e.g., “I try to translate new information into my own words”). Comprehension Monitoring measured assessment of one’s learning or use of strategies (e.g., “I ask myself periodically if I am meeting my goals”). Debugging Strategies relate to the strategies students use to correct comprehension and performance errors (e.g., “I re-evaluate my assumptions when I get confused”). Lastly, Evaluation measured analysis of performance and effectiveness of previous learning strategies (e.g., “I ask myself how well I accomplish my goals once I’m finished”). The Regulation of Cognition Dimension of the MAI had good internal reliability for Time 1 (α = .83) and excellent reliability for Time 2 (α = .90).

Because of the questionable reliability of the Knowledge About Cognition dimension, I completed MAI analyses using both the total MAI score and the MAI dimension scores. Results were consistent across analyses, so I have chosen to report effects using the MAI total score, which had the strongest internal reliability.

Career Reflections

Career reflections were given as sham reflections that asked students to reflect on their career goals. Items on the career reflections consisted of a mixture of scale items and open-response items. For scale items, students indicated on a scale from 1 (*very true*) to 5 (*very untrue*) how much they agree with a statement (e.g., “I think the content we discussed for this unit or activity will be applicable to my future career.”). Students were prompted to reflect on their career for open-response items (e.g., “Write down one main idea that you hope to remember from this unit or activity, long after this course is over.”).

These career reflection prompts have been used in past studies (Masland, 2019), but the language and number of items were modified for class activity reflections to accommodate the type of activity. As such, class activity career reflections (Appendix B)

were the shortest with three items, whereas exam career reflections (Appendix C) consisted of five items each.

Metacognitive Wrapper Reflections

Metacognitive wrapper reflection prompts in this study were adapted from a sample provided by Lovett (2013) and used in past studies (Masland, 2019). The prompts were designed to meet the criteria for designing wrappers established by Lovett in terms of length of time to complete, which items to include, and what to use wrappers for. As recommended by Lovett, there were multiple opportunities for students to reflect on course work and practice metacognitive skills, and wrappers were implemented across a diverse range of assessments such as exams and in-class activities. Wrapper prompts were slightly modified for the two assessments.

Similar to Chew et al. (2016), I utilized a combination of exam wrappers and activity wrappers. However, because this course did not have homework assignments that receive instructor feedback, students were asked to complete wrappers for two in-class activities. By following a similar procedure as Chew et al. (2016), class activity wrappers (Appendix D) were completed prior to the exam and directly related to the content on the exam. The format of the class activity wrapper was adapted from Lovett (2013) and was designed to have fewer items than other wrappers so that they could be completed quickly. The class activity wrappers consisted of three items and had a mixture of scale items and open-response items. For scale items, students indicated on a scale from 1 (*Very true*) to 5 (*Very Untrue*) how much they agree with a statement (e.g., “I feel confident in my ability to complete another activity like the one completed today”). Students were prompted to reflect on their

performance for open-response items (e.g., “Based on the instructor feedback, what was an area of strength for you on this activity?”).

In addition to a variety of low-stakes assessments, this course had three non-cumulative online, take-home exams. Exams consisted of 15 multiple choice items and a choice between two case study essay prompts. Students reflected only on the essay portion of the exam because students should be able to improve their case conceptualization skills for the next exam based on the feedback provided on previous exams. Similar to class activity wrappers, exam wrappers (Appendix E) consisted of a combination of open-ended items and scale items on a scale from 1 (*Very true*) to 5 (*Very Untrue*). Exam wrapper items directly related to the three metacognitive skills in the two dimensions of the MAI (i.e., Knowledge About Cognition and Regulation of Cognition). As such, students reflected on their Knowledge About Cognition in this class (e.g., “I put a sufficient amount of effort into writing this exam essay”) and Regulation of Cognition (e.g., “Write three action steps you plan to take between now and the next exam to achieve your goal”).

Procedure

Two weeks after the start of the semester (after the add/drop period), students were notified of the intent to use course surveys, reflections, and personal performance data. Participation was voluntary, and students completed an informed consent form (Appendix F). The study was determined exempt from review by the university’s Institutional Review Board (IRB, Appendix G).

During class, the instructor of record read a script (Appendix H) outlining data collection in the classroom. After, students navigated to the survey on the online course management system via university-issued iPads or personal electronic devices. The link

directed students to Qualtrics where they read the consent form and selected whether they wanted their data to be included in analyses. The instructor examined the data only after final grades were submitted to the university at the end of the semester. In addition, the instructor was the only person to have access to all of the study data (i.e., academic performance and survey responses linked to student names). To ensure study privacy, the instructor created a linking file that aligns student names with identification numbers which were kept in a locked filing cabinet in their office. After the data set was deidentified, I no longer needed to access the students' educational records for the purposes of analyzing the deidentified data.

MAI Course Survey

Immediately after the consent form, students who elected to participate in the study were automatically directed to the MAI (Time 1). Students had ample time to complete the course survey. Following a similar procedure, students completed the MAI a second time (Time 2) at the end of the semester during Week 15 and 16 to allow researchers to assess changes in students' metacognitive awareness. There were two main differences at Time 2. First, students did not receive the consent form again. Second, due to the transition from in-person to online course instruction due to COVID-19, students completed the MAI Time 2 at home on their own time.

Reflections

All students received participation points for submitted reflections, despite the quality of the reflection. That is, students could receive credit simply for clicking into the reflection assignment, regardless of whether they actually completed the reflection. Upon further inspection, all students answered the scale items and typed responses to the reflection

prompts in the space provided. In brief, the current study utilized four reflections which totaled 2.54% of the course average (12 points out of 472).

Students were randomly assigned to either the metacognitive wrapper condition or the career reflection condition via the grouping feature in the online course management system. Students in the wrapper condition reflected specifically on instructor feedback, whereas students in the career reflection condition were given a sham reflection that asked them to reflect on their career goals. This produced 50 students in the metacognitive condition and 49 students in the career condition.

As a condition of being a student in this class, participants had access to their exam and activity scores and feedback at the time of the manipulation. This procedure simply asked half of them to navigate to that feedback for the purposes of completing the assessment reflection sheet, while the other half reflected on their career goals. In sum, students had the opportunity to complete two class activity reflections and two exam reflections. As such, students completed a total of four reflections over a period of 14 weeks: either all Metacognitive Reflections or all Career Reflections.

During the second week of class, students worked in small groups to complete an in-class activity in Google Docs. In the following class period, students had access to instructor feedback via Google Docs. After students reviewed their feedback, they were directed to the course section on the online course management system to complete a reflection. Students had five minutes to complete the reflection activity. This same procedure was repeated after another in-class activity during Week 4.

Students completed exam reflections after Exam 1 in preparation for Exam 2. After Exam 2, students completed another exam reflection in preparation for Exam 3. Given that

all exams for this course were administered online and taken outside of class, students completed exam reflections in class once feedback was provided (approximately one week after the exam deadline). The instructor graded the essay portion of the exam and provided students with written feedback via a rubric that included both quantitative and qualitative feedback. After students reviewed the exam, rubric, feedback, and grade, they were asked to complete a reflection. Since exam reflections consisted of more questions than class activity reflections, students had ten minutes to complete the reflection activity in the online course management system. The time limit was ten minutes because this is a replication of past work (i.e., Masland, 2019) and because wrappers were meant to impinge minimally on class time (Lovett, 2013). Students completed their first exam reflection during Week 5 of the semester for Exam 1.

When it was time for students to complete reflections for Exam 2, the university switched to online instruction due to COVID-19. Because of this, students completed Exam 2 reflections online on their own time during Week 10. A full timeline of the study procedure is located in Appendix I.

Plan of Analysis

I used IBM Statistical Package for Social Sciences (SPSS), version 25, to perform the appropriate statistical analyses. An a priori G*power analysis (Faul et al., 2007) was conducted to estimate the required sample size based on the following parameters: 80% power for a medium effect size ($d = 0.25$) using a repeated measures Analysis of Variance (ANOVA), between factors design with two groups and three measurements. The estimate determined a total sample size of 86 participants.

Participants were excluded from analyses if they were missing data for the MAI at Time 1 or Time 2 as well as any of the reflections. Though the sample size was adequate at the start of the semester per the recommendation of the power analysis, only 54 of the participants produced complete data. This resulted in 30 participants in the metacognitive condition and 24 participants in the career condition with complete data (i.e., submitted all four reflections and completed the exams).

Academic Performance

I sought to better understand whether metacognitive wrappers improved scores on academic outcomes. The primary hypothesis investigated whether students who engage in metacognitive wrappers had better performance outcomes in the form of a final grade for the course than those who did not engage in metacognitive wrappers. To test this hypothesis, I conducted a one-way ANOVA for Condition (Metacognitive vs. Career).

I was also interested in whether students in the metacognitive wrapper condition improved on subsequent exams. I analyzed the data using a two-way repeated measures ANOVA for Exam (1 and 2) x Condition (Metacognitive vs. Career). Although students did complete an exam reflection after Exam 2, the instructor made course changes in response to the COVID-19 crisis, such that Exam 3 was no longer a required course assessment. Therefore, although the intention was to examine patterns of performance across the three exams, only performance from Exam 1 to Exam 2 could be considered in this study.

Metacognition

Regarding metacognition, I was interested in whether metacognitive skills changed over a semester as well as whether metacognitive skills improved as a function of engaging in post-exam and post-activity metacognitive wrappers. I expected that metacognitive skills

would improve across the semester and that there would be a greater change in scores for those in the metacognitive wrapper condition. To test these hypotheses, I conducted a two-way repeated measures ANOVA for metacognitive skills at Time 1 and Time 2 x Condition (Metacognitive vs. Career). To test the hypothesis that metacognitive skills improved across the semester, I examined the main effect of time. To test my more specific hypothesis that metacognitive skills would increase as a function of metacognitive wrappers, I looked for evidence of an interaction between time and condition, with students in the metacognitive wrapper showing a greater increase in metacognitive skills than students in the control condition.

Results

Means, standard deviations, and sample sizes for each condition for analyses regarding academic performance and scores on the MAI can be found in Table 1.

Academic Performance

To test the hypothesis that those in the Metacognitive condition outperformed those in the Career condition, I conducted a one-way ANOVA to compare mean course grades in the two conditions. Final course grades were converted to a 100-point grading scale (100%) by dividing the number of earned points by 472, the total possible points in the course. I found that differences in final grades were not significantly greater in the Metacognitive condition (M = 91.10, SD = 4.33) compared to the Career condition (M = 89.74, SD = 6.08), $F(1, 52) = 0.91$, $p = .345$, $d = .26$. These findings do not support the hypothesis, such that students who completed metacognitive reflections did not receive higher grades than students who reflected on their future careers.

For the second outcome of concern, I investigated the hypothesis that exam performance would improve for those who completed the metacognitive reflection compared to the career reflection. Exam grades were converted to a 100-point grading scale (100%) by dividing the number of earned points by 40, the total possible points on the essay portion of the exam. I ran a two-way repeated measures ANOVA for Exam (1 and 2) x Condition (Metacognitive vs. Career). Using Wilks' lambda, I found that the change in grades from Exam 1 to Exam 2 did not significantly differ by condition (Metacognitive condition (M_{exam1} = 83.18, SD = 15.18 and M_{exam2} = 80.75, SD = 13.30); Career condition (M_{exam1} = 80.23, SD = 15.73) and M_{exam2} = 80.65, SD = 15.38), $F(1, 50) = 0.21$, $p = .646$, $\eta^2 = .06$). These findings do not support the hypothesis, such that students who repeatedly complete metacognitive reflections did not perform better on subsequent exams than those who reflect about their career.

Metacognition

To test the hypothesis that metacognitive skills improved as a function of engaging in metacognitive wrappers, I conducted a two-way repeated measures ANOVA for Metacognition (Time 1 and Time 2) x Condition (Metacognitive vs. Career). The scores on the MAI were converted to ratios by taking the number of true responses across the 52 items. Values ranged from zero to one, where scores closer to zero reflect a greater endorsement of "false" responses or fewer metacognitive skills, and scores closer to one reflect a greater endorsement of "true" responses or more metacognitive skills. Using Wilks' lambda, I found that MAI score averages did significantly improve across the semester from Time 1 (M = .74, SD = .14) to Time 2 (M = .81, SD = .16) for all students, $F(1, 52) = 15.81$, $p < .001$, $d = .47$. However, the interaction of Time x Condition was not significant, $F(1, 52) = 1.28$, $p = .264$,

d = .01 (see Figure 1). These findings do not support the hypothesis; as such, metacognitive skills for students who engage in metacognitive reflection do not improve at a greater rate than those who reflect on their career. In other words, metacognitive skills improved over the semester, but this was not due to the metacognitive wrapper.

Discussion

The current study aimed to examine whether an increased number (i.e., a total of four) and variety (i.e., activity and exam) of metacognitive wrappers aided metacognition and academic performance in a single-course intervention by randomly assigning students to one of two conditions (Metacognitive or Career). I predicted that students who engaged in metacognitive reflection would have better grades, in terms of exam performance and final course average, as well as improve more compared to students who engaged in career reflections. Additionally, I expected that metacognitive skills would improve over the course of the semester more sharply for students who engage in metacognitive reflection four times across the semester than those who engage in career reflections the same number of times.

Academic performance, in terms of exam grades and final grades, did not improve as a result of completing metacognitive wrappers compared to the control group. This suggests that, contrary to the hypothesis, metacognitive wrappers are not effective at improving academic performance on subsequent activities or in the course overall. Similar to some past studies that found null effects of exam wrappers (e.g., Butzler, 2016; Lemons et al., 2013; Rowell et al., 2020; Soicher & Gurung, 2017; Stephenson et al., 2017; Thompson, 2012), this study further perpetuates the idea that exam wrappers do not always enhance academic performance as expected.

However, other researchers have found positive effects on grades when engaging in exam wrappers (e.g., Achacoso, 2005; Cathey et al., 2020; Edlund, 2020; Pate et al., 2019; Smith et al., 2019; Thompson, 2012). In hindsight, there is an additional factor that might have influenced past findings. That is, Edlund (2020) returned exam wrappers to students one week prior to the next exam to remind them of their strengths, areas of improvement, previously set goals, and strategies to obtain their goals. Perhaps, as a result of not returning the wrappers to students in the current study, the wrapper was not used effectively as a reminder for students to prepare for the next exam. Future studies should consider mirroring the procedure used by Edlund (2020) and Soicher & Gurung (2017), where instructors return the completed exam wrapper to students before the next exam; for the most robust study, researchers should consider returning the wrapper one week before the next exam to ensure the best results, modeling Edlund (2020).

Metacognition, on the other hand, improved over the course of the semester despite reflection type. In other words, inconsistent with my hypothesis, students who engage in metacognitive reflections did not gain metacognitive skills at a quicker rate than students who engaged in career reflections. Though not expected, these findings are consistent with several past studies (e.g., Soicher & Gurung, 2017; Thompson, 2012). Interestingly, despite the disruption caused by COVID-19, average metacognitive skills improved from the start of the semester to the end of the semester for all students, again, mirroring past research (Soicher & Gurung, 2017; Thompson, 2012). Therefore, although the metacognitive wrappers used in this study were designed based on Lovett's (2013) recommendations and should have produced distinct metacognitive gains for those in the experimental condition,

metacognitive wrappers did not positively affect metacognitive skills over the semester in this single course intervention**.**

Limitations and Future Directions

As is the case with all research, there are a few limitations of the current study. The first major restriction was the number of reflection opportunities offered throughout the semester. The original purpose of this study was to provide students with as many reflection opportunities as possible using a variety of activity types (activities, exams, and the project), for a total of five reflections. However, due to COVID-19 and an extra week of spring break, the culminating project reflection activity was dropped along with its corresponding reflection activity, leaving students with only four reflection opportunities. Luckily though, modality of the exams remained the same (i.e., all online); however, students had an extended amount of time to complete Exam 2. This change in research design made it impossible to test one of the key components of this study--that more metacognitive reflections (at least in comparison to past studies) are needed to show effects.

Furthermore, classroom structure switched from in-person to online-only halfway through the semester as a result of precautionary action in response to COVID-19. Not only could this change in course modality have affected student performance, but also student retention and attrition. There are a few possibilities that could have impacted attrition in this study. First, students might have had difficulty adapting with the transition from in-person to online classes due to a variety of issues such as the lack of internet connection or access to technology, making it difficult to complete the class. Another possibility is that students saw the wrappers as an additional, unnecessary task once having to adjust to the new environment, thus, resulting in fewer students who completed them. Regardless, the attrition

rate was the ultimate downfall of the current study. Upon further inspection, however, the data was missing at random, and the same number of students were dropped for missing the first reflection (because they were out of class that day) as were dropped from the last reflection (possibly because of COVID-19). Although there was an appropriate sample at the start of the study and results showed interesting descriptive differences between conditions, those differences were not statistically significant in part due to attrition and lack of power. Due to a large percent (37%) of participants' data that was unusable, the current study lacks the ability to draw conclusions. Thus, to gain enough power to draw the appropriate conclusions, we would need a much larger sample size to even detect a significant effect.

Another issue regarding attrition is that the students who were dropped from the study due to incomplete data (i.e., missing one or more of the reflections or assessments) were different from those who had complete data. When looking back at Exam 1, the first grade of the semester, students with complete data had a higher average score (M = 82.50, SD = 14.46) than students missing one or more data points (M = 70.00, SD = 17.53), $F(1, 82)$ = 292.92, p = .006, d = . In fact, the student group with missing data shows lower performance on most assessments throughout the course. It is possible, then, that grades did not improve for those in the intervention condition because those students with complete data were already strong students. Perhaps the students whose data we dropped from the study were the ones who might have shown the most benefit. However, given that the data, the current study cannot conclude whether low achievers might show particular benefit from this intervention.

In addition to these uncontrollable factors, the reliability for one of the dimensions of the metacognitive measures had poor reliability at Time 1 and questionable reliability at Time 2. Since the overall reliability of the MAI was considered good and excellent at Time 1

and Time 2, respectively, I analyzed only the MAI total score. Though results showed that metacognitive skills improved over the semester for each condition, the psychometric properties of this instrument are worth considering. Interestingly, past research has dubbed this a validated and reliable measure (Harrison & Vallin, 2018; Schraw & Dennison, 1994). However, we see a similar trend in Soicher and Gurung (2017), where the reliability for the Knowledge about Cognition Dimension (α = .54) and the Regulation of Cognition Dimension (α = .63) also significantly suffered. This leads us to question why this might happen. Perhaps future researchers should consider a different measure of metacognition altogether to ensure more reliable findings.

Lastly, like most studies, I recommend that future researchers and instructors determine for themselves whether metacognitive wrappers will work in their own classroom with their style of teaching. Also, consider that metacognitive reflection may not work for every instructor and student; results may depend on the type of class (e.g., psychology, biology, teaching), semester (e.g., fall, spring, summer), and grade level (e.g., Freshman, Sophomore, Junior, Senior). Of note, students in the present study were taking an educational psychology course, a class required for those majoring in teaching. Perhaps one reason all students in this course gained metacognitive skills is because these students value learning and strive to do their best regardless of an intervention. It is also relevant to note that metacognition was taught as a portion of the course content, so it is possible that students gained more from the content of instruction than they did from the experimental manipulation in this particular course. Forthcoming researchers should further explore these variables as contributing factors to their effectiveness in academic performance and metacognitive skills.

Conclusion

Given the COVID-19 disruption, this research became an extension of past studies (e.g., Masland, 2019) and a conceptual replication of Chew et al. (2016) which investigated the relationship of metacognitive reflection to academic performance and metacognitive skills. While the findings regarding the main hypotheses were not significant, this research shows that metacognitive skills improved over the semester, despite unprecedented times. That is to say that even in the face of extreme disruptions, some students (at least the 54 who kept participating) were able to still show the metacognitive growth that other studies have shown in non-pandemic times (e.g., Soicher & Gurung, 2017; Thompson, 2012), suggesting that a majority of students demonstrated resilience by continuing to participate and engage in-class activities. In conclusion, this study expanded the understanding and use of metacognitive reflection, or exam wrappers, in higher education and is a model for quality experimental research in education and scholarly endeavors.

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Tables and Figures

Table 1

Average Grades and Metacognitive Skills for Metacognitive and Career Conditions

		Condition			
		Metacognitive Condition		Career Condition	
Grades [a]		*n*	*M* (*SD*)	*n*	*M* (*SD*)
	Exam 1	30	83.18 (15.18)	22	80.23 (15.73)
	Exam 2	30	80.75 (13.30)	22	80.65 (15.38)
	Final Grade	30	91.10 (4.33)	24	89.74 (6.08)
MAI Scores [b]					
	Time 1	30	.75 (.15)	24	.72 (.13)
	Time 2	30	.84 (.12)	24	.77 (.19)

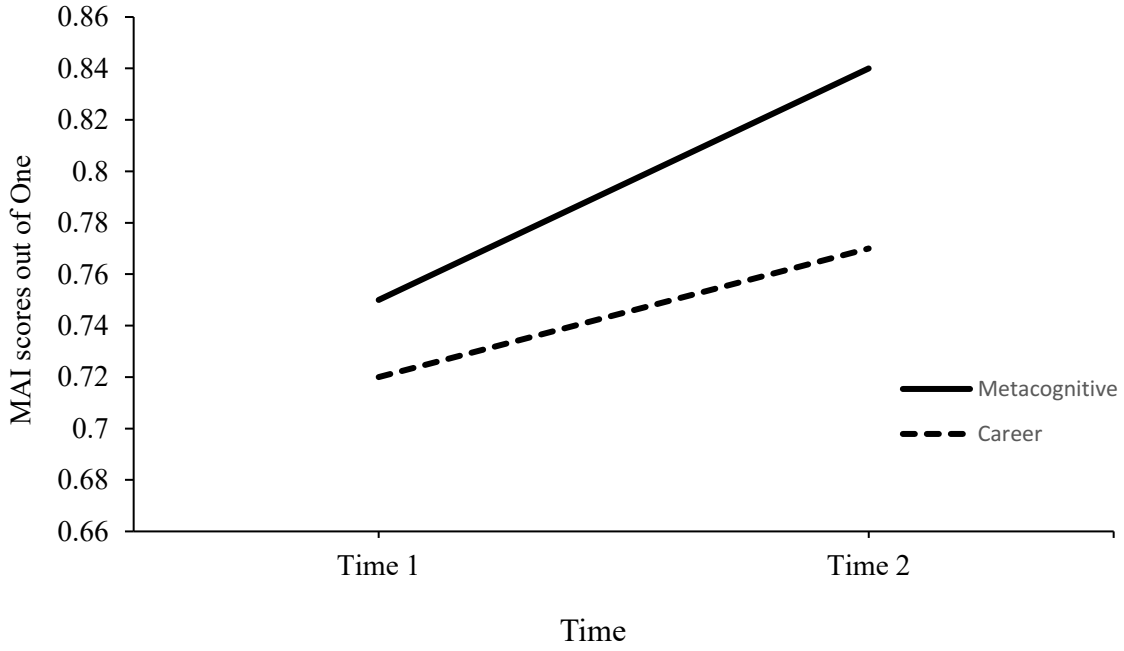
Note. This table demonstrates the averages of student grades and metacognitive skills for each condition (Metacognitive vs Career).

[a] Grades are representative of a 100-point grading scale (100%), where higher grades equal better performance.

[b] Metacognitive Awareness Inventory (MAI) scores were converted to a ratio. Values range from zero to one, where scores closer to zero reflect greater endorsement of “false” responses or fewer metacognitive skills, and scores closer to one reflect greater endorsement of “true” responses or more metacognitive skills.

Figure 1

Average Scores of the Metacognitive Awareness Inventory for Metacognitive and Career Conditions



Note. Metacognitive Awareness Inventory (MAI) scores were converted to a ratio. Values range from zero to one, where scores closer to zero reflect greater endorsement of "false" responses or fewer metacognitive skills, and scores closer to one reflect greater endorsement of "true" responses or more metacognitive skills. Differences in metacognitive scores between conditions from Time 1 to Time 2 were not significant.

Appendix A

Metacognitive Awareness Inventory (MAI)

Instructions:

Think of yourself as a learner. Read each statement carefully. Consider if the statement is true or false as it generally applies to you when you are in the role of a learner (student, attending classes, university etc.) in this class. Select True or False as appropriate.

1. I ask myself periodically if I am meeting my goals.
2. I consider several alternatives to a problem before I answer.
3. I try to use strategies that have worked in the past.
4. I pace myself while learning in order to have enough time.
5. I understand my intellectual strengths and weaknesses.
6. I think about what I really need to learn before I begin a task.
7. I know how well I did once I finish a test.
8. I set specific goals before I begin a task.
9. I slow down when I encounter important information.
10. I know what kind of information is most important to learn.
11. I ask myself if I have considered all options when solving a problem.
12. I am good at organizing information.
13. I consciously focus my attention on important information.
14. I have a specific purpose for each strategy I use.
15. I learn best when I know something about the topic.
16. I know what the teacher expects me to learn.
17. I am good at remembering information.

18. I use different learning strategies depending on the situation.
19. I ask myself if there was an easier way to do things after I finish a task.
20. I have control over how well I learn.
21. I periodically review to help me understand important relationships.
22. I ask myself questions about the material before I begin.
23. I think of several ways to solve a problem and choose the best one.
24. I summarize what I've learned after I finish.
25. I ask others for help when I don't understand something.
26. I can motivate myself to learn when I need to.
27. I am aware of what strategies I use when I study.
28. I find myself analyzing the usefulness of strategies while I study.
29. I use my intellectual strengths to compensate for my weaknesses.
30. I focus on the meaning and significance of new information.
31. I create my own examples to make information more meaningful.
32. I am a good judge of how well I understand something.
33. I find myself using helpful learning strategies automatically.
34. I find myself pausing regularly to check my comprehension.
35. I know when each strategy I use will be most effective.
36. I ask myself how well I accomplish my goals once I'm finished.
37. I draw pictures or diagrams to help me understand while learning.
38. I ask myself if I have considered all options after I solve a problem.
39. I try to translate new information into my own words.
40. I change strategies when I fail to understand.

41. I use the organizational structure of the text to help me learn.
42. I read instructions carefully before I begin a task.
43. I ask myself if what I'm reading is related to what I already know.
44. I reevaluate my assumptions when I get confused.
45. I organize my time to best accomplish my goals.
46. I learn more when I am interested in the topic.
47. I try to break studying down into smaller steps.
48. I focus on overall meaning rather than specifics.
49. I ask myself questions about how well I am doing while I am learning something new.
50. I ask myself if I learned as much as I could have once I finish a task.
51. I stop and go back over new information that is not clear.
52. I stop and reread when I get confused.

Appendix B

Class Activity Career Reflection

1. I think the content we discussed for this activity will be applicable to my future career.

Very True	Somewhat True	Neutral	Somewhat Untrue	Very Untrue
1	2	3	4	5

2. I learned a lot of new ideas in this activity.

Very True	Somewhat True	Neutral	Somewhat Untrue	Very Untrue
1	2	3	4	5

3. Write down one main idea that you hope to remember from this activity, long after this course is over.

Appendix C

Exam Career Reflection

1. I think the content we discussed for this unit will be applicable to my future career.

Very True	Somewhat True	Neutral	Somewhat Untrue	Very Untrue
1	2	3	4	5

2. I learned a lot of new ideas in this unit.

Very True	Somewhat True	Neutral	Somewhat Untrue	Very Untrue
1	2	3	4	5

3. Review the solution you suggested (i.e., your part Cs) for the hypothetical teacher in your exam essay. Which of them do you expect you will use when you are a teacher? Why?
4. Write down one main idea that you hope to remember from this unit, long after this course is over.
5. Write three action steps you plan to take as a teacher/other professional that will support what you learned about the main idea listed in #4 above.

Appendix D

Class Activity Wrapper

1. I feel confident in my ability to complete another activity like the one completed today.

Very True	Somewhat True	Neutral	Somewhat Untrue	Very Untrue
1	2	3	4	5

2. I put a sufficient amount of effort into this in-class activity.

Very True	Somewhat True	Neutral	Somewhat Untrue	Very Untrue
1	2	3	4	5

3. Based on the feedback, what was an area of strength for you on this activity?

Appendix E

Exam Activity Wrapper

1. I am satisfied with the score that I received on my exam essay.

Very True	Somewhat True	Neutral	Somewhat Untrue	Very Untrue
1	2	3	4	5

2. I put a sufficient amount of effort into writing this exam essay.

Very True	Somewhat True	Neutral	Somewhat Untrue	Very Untrue
1	2	3	4	5

3. Based on the rubric scoring and feedback comments on your essay, what was an area of strength for you on this assessment?
4. Set a goal for yourself for the next exam essay. Write it below.
5. Write three action steps you plan to take between now and the next exam to achieve your goal.

Appendix F

Consent to Participate in Research

Title: Reflections, Exam Scores, and Final Project Grade
Principal Investigator: Jessica Chambers, B.S., Department of Psychology
Principal Investigator Faculty Advisor: Lindsay Masland, Ph.D., Department of Psychology
Contact Information: Jessica Chambers – chambersjm1@appstate.edu
Lindsay Masland – (828) 262-8954; maslandlc@appstate.edu

Information to Consider About this Research

You are being invited to take part in a research study about Dr. Masland's approach to teaching. If you take part in this study, you will be one of about 100 people to do so. By doing this study, we hope to better understand which teaching methods are the most effective in supporting college students.

If you agree to participate, you will be asked to complete a 10-minute reflection on AsULearn at several different points during the semester. These reflections will occur during class and will ask you to think about topics such as course performance and your intended future career.

Also, at the end of your PSY 3010 course, Dr. Masland would like to add your exam grades and final project grade to a database that will allow her to examine how these in-class reflections relate to exam performance.

You cannot volunteer for this study if you are under 18 years of age.

What are possible harms or discomforts that I might experience during the research?

To the best of my knowledge, the risk of harm for participating in this research study is no more than you would experience in everyday life. Your PSY 3010 experience will be the same, regardless of whether you grant consent to participate in this study. Dr. Masland will not compile the participation and exam data from this study until grades have been submitted for this course, so your performance will not be affected in any way.

What are the possible benefits of this research?

Dr. Masland will be able to use this data to inform her own teaching, and dissemination of trends revealed could help other college instructors improve their teaching, as well. Jessica will be able to use this data to build on the existing research of teaching practices and complete her master's thesis. Also, reflecting on your experiences may help you to learn more in this class and in future classes.

Will I be paid for taking part in the research?

You will not be paid to participate in this research.

How will you keep my private information confidential?

Your identifying information (i.e., name) will be removed from the database, and your data will be assigned a participant ID number. A document linking your name to your participant ID number will be kept separate from the course data database, and all analyses will be completed confidentially.

Who can I contact if I have questions?
The person conducting this study will be available to answer any questions concerning this research, now or in the future. You may contact the Principal Investigators through the following:

Lindsay Masland – (828) 262-8954, maslandlc@appstate.edu

If you have questions about your rights as someone taking part in research, contact the Appalachian Institutional Review Board Administrator at 828-262-2692 (days), through email at irb@appstate.edu or at Appalachian State University, Office of Research and Sponsored Programs, IRB Administrator, Boone, NC 28608.

Do I have to participate? What else should I know?

Your participation in this research is completely voluntary. If you choose not to volunteer, there will be no penalty and you will not lose any benefits or rights you would normally have. If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. There will be no penalty and no loss of benefits or rights if you decide at any time to stop participating in the study.

Once we have collected all the data, we will make the dataset publicly available by posting on our project page on the Open Science Framework (https://osf.io/yx69m/). Your name will not be in this dataset, but your responses to the survey will be.

Appalachian State University's Institutional Review Board has determined this study to be exempt from IRB oversight.

_____ YES, I would like to participate in this research study.

_____ NO, I would not like to participate in this research study

_____

_____

Participant's Name (PRINT) Signature Date

Appendix G

Institutional Review Board Exemption

From: IRB <irb@appstate.edu>
Sent: Tuesday, January 14, 2020 4:16 PM
To: chambersjm1@appstate.edu; maslandlc@appstate.edu
Subject: IRB Notice - 20-0163

To: Jessica Chambers
Psychology
CAMPUS EMAIL

From: Nat Krancus, IRB Administrator
Date: 1/14/2020
RE: Notice of Exempt Research Determination

STUDY #: 20-0163
STUDY TITLE: Feedback Reflection, Exam and Activity Scores, and Final Grade

Exemption Category: 1. Educational setting

This study involves no more than minimal risks and meets the exemption category or categories cited above. In accordance with the 2018 federal regulations regarding research with human subjects [45 CFR 46.101(b)] and University policy and procedures, the research activities described in the study materials are exempt from IRB review. If this study was previously reviewed as non-exempt research under the pre-2018 federal regulations regarding research with human subjects, the Office of Research Protections staff reviewed the annual renewal and the initial application and determined that this research is now exempt from 45 CFR 46.101(b) and thus IRB review.

What a determination of exempt research means for your project:

1. The Office of Research Protections staff have determined that **your project is research, but it is research that is exempt from the federal regulations regarding research.**
2. Because this research is exempt from federal regulations, **the recruitment and consent processes are also exempt from IRB review.** This means that the procedures you described and the materials you provided were not reviewed Office of Research Protections staff, further review if these materials are not necessary, and you can change these procedures and materials without review from this office. You can use the consent materials you may have provided in the application, **but you can change the consent procedures and materials without submitting a modification. Note that if your consent form states that the study was "approved by the IRB"**

this should be removed. You can replace it with a sentence that says that the study was determined to be exempt from review by the IRB Administration.

3. **You still need to get consent from adult subjects and, if your study involves children, you need to get assent and parental permission.** At the very least, your consent, assent, and parental permission processes should explain to research subjects: (a)the purpose, procedures, risks, and benefits of the research; (b) if compensation available; (c) that the research is voluntary and there is no penalty or loss of benefits for not participating or discontinuing participation; and (d) how to contact the Principal Investigator (and faculty advisor if the PI is a student). You can also use exempt research consent template, which accounts for all of these suggested elements of consent: https://researchprotections.appstate.edu/sites/researchprotections.appstate.edu/files/Exempt%20Consent%2012.18.13.docx.
4. **Special Procedures and populations for which specific consent language is suggested.** Research involving children, the use of the SONA database for recruitment, research with students at Appalachian State University, or MTurk should use the specific language outlined by Office of Research Protections on our website: https://researchprotections.appstate.edu/human-subjects-irb/irb-forms.
5. **Non-procedural Study Changes:** most changes to your research will not require review by the Office of Research Protections. However, the following changes require further review by our office:

- the addition of an external funding source,
- the addition of a potential for a conflict of interest,
- a change in location of the research (i.e., country, school system, off site location),
- the contact information for the Principal Investigator,
- the addition of non-Appalachian State University faculty, staff, or students to the research team, or

6. **Changes to study procedures.** If you change your study procedures, you may need to submit a modification for further review. Changes to procedures that may require a modification are outlined in our SOP on exempt research, a link to which you can find below. Before submitting a modification to change procedures, we suggest contacting our office at irb@appstate.edu or (828)262-4060.

Investigator Responsibilities: All individuals engaged in research with human participants are responsible for compliance with University policies and procedures, and IRB determinations. The Principal Investigator (PI), or Faculty Advisor if the PI is a student, is ultimately responsible for ensuring the protection of research participants; conducting sound ethical research that complies with federal regulations, University policy and procedures; and maintaining study records. The PI should review the IRB's list of PI responsibilities.

To Close the Study: When research procedures with human participants are completed, please send the Request for Closure of IRB Review form to irb@appstate.edu.

If you have any questions, please contact the IRB Administrator at (828) 262-4060.

Best wishes with your research.

Important Links for Exempt Research:
Note: If the link does not work, please copy and paste into your browser, or visit https://researchprotections.appstate.edu/human-subjects.
1. Standard Operating Procedure for exempt research (#9): https://researchprotections.appstate.edu/sites/researchprotections.appstate.edu/files/sop_9_approved_1.21.2019.pdf
2. PI responsibilities: https://researchprotections.appstate.edu/sites/researchprotections.appstate.edu/files/PI%20Responsibilities.pdf
3. IRB forms: http://researchprotections.appstate.edu/human-subjects/irb-forms

Appendix H

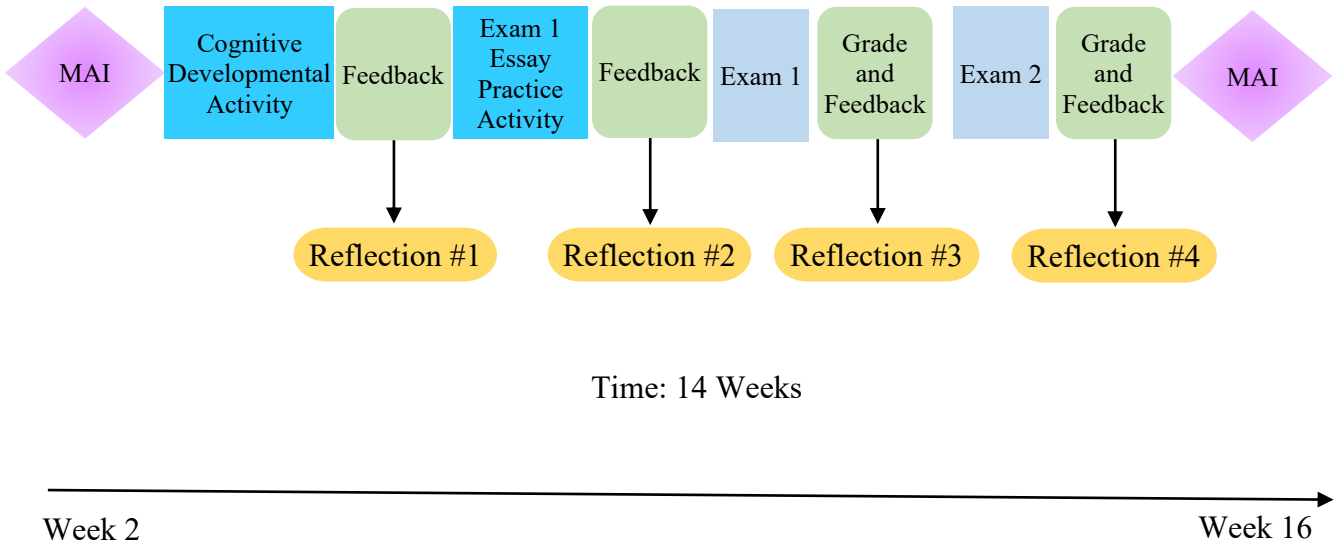
Script

"Good morning (afternoon). I am here to see if you might be interested in participating in a research study that your instructor and her research team are completing about how reflecting on exam feedback can improve exam scores. We are asking everyone in the instructor's classes to participate in this study by completing a reflection activity about the feedback on your most recent exam or activity. We will ask you to do these reflections six times across the semester. In addition, we will ask you to complete a course survey on study habits today, at the beginning of the semester, and again, at the end of the semester. Your professor will not look at any of your answers until the course is over. At that time, your professor will look to see how reflecting on exam feedback affected your later exam performance as well as the course survey. To reiterate, she will not look at any of this until the course is over.

Participation is voluntary. There is no monetary compensation for participating, but your participation in this reflection activity could lead to improved exam performance. Additionally, participation will help us gather information that might improve students' learning in the future, including your own. Does anyone have any questions?"

Appendix I

Timeline of Assessments and Reflections



Vita

Jessica Michelle Chambers was born in Knoxville, Tennessee, to Karen Frazier and Steve Chambers. As a first-generation college student, she attended Walters State Community College in 2016, where she graduated Cum Laude with an Associate of Science in Psychology. Two years later, Jessica graduated Summa Cum Laude from East Tennessee State University (ETSU) with her Bachelor of Science degree in Psychology in 2018. She was also honored as a McNair and Midway Honors scholar. She continued her academic career the following autumn at Appalachian State University to earn her Master of Arts in Experimental Psychology.

Currently, Jessica remains active in research and works closely with undergraduate students who are a part of ETSU's TRiO Program. Specifically, she is a facilitator for the Ronald E. McNair program in the summer and a tutor for Student Support Services during the academic year. Jessica will be applying to psychology Ph.D. programs in the hopes of beginning a doctoral program in the fall of 2022. Long-term, Jessica strives to one day be a professor of psychology with expertise in the Scholarship of Teaching and Learning and a particular focus on first-generation college students.